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In Reply:

We thank Dr. Dexter for his comments about our recent article.¹ We agree with him about the need for effective leadership practices to be rooted in both evidenced-based behavioral and management science.

The efficiency measures presented in our case were selected for illustration purposes but do reflect an aggregate of practices that we understand have been implemented at various institutions, even if some of them may be misguided as highlighted by Dr. Dexter. The reaction of the residents to such efficiency measures is based on discussions by Dr. Scemama with residents at his and other institutions.

Dr. Dexter seems to draw a distinction between behavioral and leadership principles. As discussed in our case scenario, the foundation of leadership is behavioral,¹ and effective leadership requires the ability to recognize and to navigate both our own and others' cognitive, emotional, and relational biases. The successful implementation of process improvement requires both sound management science and effective leadership. We believe that the intersection between effective leadership and management science in anesthesiology is an exciting area for further investigation.

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Facemask Ventilation and Neuromuscular Blockade in Anesthetized Patients

To the Editor:

In a thought-provoking study, assessing the effects of muscle relaxants on facemask ventilation (FMV) in the anesthetized patients with normal upper airway anatomy, Ikeda *et al.*¹ showed that rocuronium did not deteriorate FMV without airway interventions, and FMV was improved after succinylcholine administration in association with airway dilation during pharyngeal fasciculation. However, apart from the limitations described in the discussion, there are two aspects of this study that should be discussed.

First, it would be interesting to know why this study was performed in a neutral head and mandible position without airway interventions, which are not the practical airway management methods during anesthesia induction. Actually, upper airway obstruction is common during anesthesia induction due to loss of muscle tone present in the awake state.² To obtain an adequate FMV and then make an easy laryngoscopy, a sniffing position is generally recommended in the clinical practice, especially for the patients with a difficult airway.^{2,3} A previous study from the authors' team in patients with obstructive sleep apnea showed that compared with the neutral position, the sniffing position structurally improved maintenance of the passive pharyngeal airway at both retropalatal and retroglottal segments,⁴ which are the most common sites of upper airway obstruction.⁵ Moreover, the simple airway interventions, such as head tilt, jaw thrust, and open mouth (known as the triple airway maneuver), are the reliable methods frequently used to achieve upper airway patency in the anesthetized patients.² The another study from the authors' team showed that anesthesia induction and complete paralysis caused the upper airway obstruction in all patients with obstructive sleep apnea when the jaw thrust was not performed, while a combination of head tilt and jaw thrust restored airway patency and allowed adequate FMV ventilation.⁶ Considering the fact that the four patients in the rocuronium group were excluded from this study because of inadequate FMV, we would like to know whether the study design required a minor or moderate upper airway obstruction by a neutral head and mandible position without airway interventions. It is certain that the head and neck position of the anesthetized patients can affect the longitudinal tension on the upper airway and the manual airway interventions may change the caliber of the retrolingual and retropalatal airways, worsening or improving airway patency.^{2,5} Thus, we believed that if the patients are placed in a sniffing position with airway interventions in this study, as needed in the routine anesthesia induction, different result would have been obtained.

Second, in this study, the endoscopy at the isthmus of the fauces showed that the narrowed oral airway space abruptly and significantly dilated during oscillatory movements of the soft palate and the tongue base (pharyngeal fasciculation) after succinylcholine administration. Thus, the FMV improvement after succinylcholine administration is contributed to reopening of the pharyngeal airway by the pharyngeal muscle contraction. However, other than the soft tissue airway at the pharynx, the laryngeal aperture is another important site that may significantly affect gas flow of the upper airway.^{2,5} It has been shown that the vocal cord closure is a primary source of difficult or impossible FMV during anesthesia induction with sufentanil.^{7,8} After anesthesia induction, it is also possible for the epiglottis to overlie and obstruct the laryngeal aperture or to seal against the posterior pharyngeal wall, especially when the patients are placed in a neutral head and mandible position without any airway intervention.⁵ Because the authors did not observe changes of both position of the epiglottis in the pharynx and configuration of the laryngeal aperture during succinylcholine-induced upper airway muscle fasciculation, contribution of these factors to the FMV improvement by succinylcholine cannot be excluded.

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Ventilation before Paralysis

To the Editor:

I read with great interest the article by Ikeda *et al.*¹ and the accompanying editorial.² Surprisingly, the editorial did not refer to the recently published findings of a prospectively assessed algorithm for difficult airway management involving 12,225 facemask ventilations (FMV).³ Patients with indications for awake fiberoptic intubation were excluded. In contrary to traditional teaching, the algorithm required that patients with greater than or equal to three risk factors for difficult airway management receive succinylcholine right after induction of anesthesia without previous assessment of quality of FMV. In patients with less than three risk factors, quality of FMV was assessed before administration of a muscle relaxant. Patients with grade I or II difficulty of FMV received a nondepolarizing muscle relaxant; patients with grade III or IV difficulty of FMV received succinylcholine.

Most relevant in this context, in no case of difficult FMV was any attempt undertaken to awaken the patient. In 56 of the 90 patients (62%) with FMV difficulty grade III, quality of FMV improved by one grade after the administration of succinylcholine. In none of the 12,003 patients with FMV difficulty grade I and II did the quality of FMV worsen after administration of the nondepolarizing muscle relaxant. This confirms previous findings showing that in patients with unimpaired⁴ or with a mix of unimpaired and moderately difficult FMV,⁵ quality of FMV either remained unchanged or improved after the administration of a muscle relaxant, but never worsened. All 12,225 patients who were routinely paralyzed, irrespective of the quality of FMV, could ultimately be orotracheally intubated using various airway devices. In another study, of 37 patients with impossible FMV, all but one were successfully intubated.⁶ The 97% intubation success rate after impossible FMV is likely to have been due to the early administration of the muscle relaxant in all but one of the 37 patients.⁷ It is questionable that endotracheal intubation could have been that successfully performed in the absence of muscle relaxation, or that these patients could have safely been awoken.

The editorialists mistakenly interpret the findings by Ikeda *et al.*¹ as showing a superior effect of succinylcholine over nondepolarizing muscle relaxants on the quality of FMV. However, as the investigators studied patients with successful FMV before administration of any muscle relaxant, the data can only be interpreted as showing that administration of muscle relaxants does not worsen preexisting effective FMV. As this had been a nonrandomized study, baseline values for nasal and oral ventilatory volumes had differed between patients receiving rocuronium or succinylcholine, and less than optimal statistical testing had been applied (use of paired Student *t* test for comparison of data from three successive observation points), the data do not necessarily support the conclusion of different effects of succinylcholine and nondepolarizing muscle relaxants on the quality of FMV.